

REMARKS

This amendment corrects errors in the text and drawings. Entry is respectfully solicited. This amendment is submitted prior to or concurrently with the payment of the issue fee and, therefore, no petition or fee is required. No new matter has been added.

Respectfully submitted,



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Enclosure: Version with Markings to Show Changes Made

Document in ProLaw

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE TITLE:

A marked-up version of the amended title, highlighting the changes thereto, follows to clearly identify the amendments:

**[METHOD OF] APPARATUS FOR ATTACHING SOLDER BALLS TO BGA PACKAGE
UTILIZING A TOOL TO PICK AND DIP THE SOLDER BALL IN FLUX**

IN THE SPECIFICATION:

A marked-up version of the amended paragraphs in the specification, highlighting the changes thereto, follows to clearly identify the amendments:

Please replace the paragraph bridging pages 3 and 4 with the following:

In United States Patent 5,620,927 of Lee, a template with an array of through-holes is placed on the workpiece and solder balls are introduced into the holes by rolling the solder balls across the workpiece surface. The apparatus may be installed on a tilt table to encourage filling of all holes. In United States Patent 4,871,110 of Fukasawa et al., a template having an array of holes is placed on a ball holder with a like array of smaller holes to which vacuum is applied and over which solder balls are rolled. After the array is filled with solder balls, the template and ball holder with balls are removed and the exposed ends of the balls are attached to a substrate by e.g. reflow. The template and ball holder are then pulled from the substrate, leaving a ball-grid-array ready for attachment to another substrate or workpiece.

Please replace the fifth full paragraph on page 6 with the following:

FIG. 11A is a sectional side view of a substrate in a process of having a ball-grid-array formed thereon in a method of another embodiment of the invention wherein the substrate holder includes a screen thereon[];

Please replace the third full paragraph on page 7 with the following:

As shown in FIG. 3, a solder ball reservoir 30 is configured to hold a large number of preformed solder balls 60 and has gas sparge holes 54 for fluidizing the balls within the reservoir, whereby the balls are attracted to and held by vacuum suction in the ball seats 36. Other alternative (or additional) means for fluidizing the balls 60 may be used, such as a vibrator [62] 63.

IN THE CLAIMS:

Pursuant to 37 C.F.R. § 1.121(c)(1)(ii), a marked-up version of each of the presently amended claims, highlighting the changes thereto, follows:

1. (Three Times Amended) A pickup tool for placing preformed solder balls on a substrate, comprising:
a tool body controllably movable in multiple axes and rotatable about an axis;
a plurality of ball seats formed in said body for said preformed solder balls, said plurality of ball seats each having an aperture therein;
passageways leading from said aperture to a vacuum source and to a pressurized gas source;
a first valve apparatus for controlling separately and independently a vacuum to said plurality of ball seats, said vacuum retaining said solder balls on said plurality of ball seats; and
a second valve apparatus for controlling separately and independently a gas under pressure to said plurality of ball seats, said gas under pressure for releasing said solder balls from said plurality of ball seats.
2. (Amended) The pickup tool of claim 1, wherein said vacuum holds said solder balls in said plurality of ball seats and said pressurized gas ejects said solder balls from said plurality of ball seats.
3. (Amended) The pickup tool of claim 1, wherein said vacuum holds said solder balls in said plurality of ball seats and said pressurized gas ejects said solder balls from said plurality of ball seats to a plurality of bond pads on said substrate.
4. (Amended) The pickup tool of claim 1, further comprising:
a controllable ball dispenser supplying said solder balls to said pickup tool, comprising:
a ramp for feeding said solder balls to said plurality of ball seats, said ramp having an upper end and a lower end;

a controllable valve at the lower end of said ramp for releasing a single solder ball of said solder balls on demand to said plurality of ball seats using a vacuum applied to said plurality of ball seats; and
a reservoir providing a supply of said solder balls to said ramp.

8. (Three Times Amended) A pickup tool for placing a plurality of solder balls on ball-grid-array bond pads of a substrate, said pickup tool comprising:
a pickup tool body with a hollow chamber therein;
a lower plate having a plurality of seats therein for retaining a solder ball in each seat, said plurality of seats corresponding to an inverted configuration of an array of bond pads on a substrate;
a plurality of passageways leading from each said seat to said hollow chamber;
a passageway leading from said chamber to a vacuum source;
a passageway leading from said chamber to a pressurized gas;
a first controllable valve apparatus for controlling opening and closing said vacuum passageway;
and
a second controllable valve apparatus for controlling opening [an] and closing said pressurized gas passageway.

10. (Three Times Amended) A pickup tool for placing preformed solder balls on a substrate, comprising:
a tool body controllably movable in multiple axes and rotatable about an axis;
a plurality of ball seats formed in said tool body for a plurality of solder balls, each ball seat of said plurality of ball seats having an aperture therein;
passageways leading from said aperture to a vacuum source and to a pressurized gas;
a first controllable valve apparatus controlling the vacuum, said vacuum retaining said plurality of solder balls in [each] said plurality of ball seats; and
a second controllable valve apparatus controlling the pressurized gas to said plurality of ball seats, said pressurized gas for releasing said plurality of solder balls from said ball seat.

11. (Amended) The pickup tool of claim 10, wherein said vacuum holds said plurality of solder balls in said plurality of ball seats and said pressurized gas ejects said plurality of solder balls from said plurality of ball seats to a bond pad on a substrate.

12. (Twice Amended) A pickup tool for placing preformed solder balls on a substrate, comprising:
a tool body controllably movable in multiple axes and rotatable about an axis;
a plurality of ball seats formed in said tool body for a plurality of solder balls, each ball seat of said plurality of ball seats having an aperture therein;
passageways leading from said aperture to a vacuum source and to a pressurized gas; and
controllable valve apparatus controlling the vacuum and the pressurized gas to said plurality of ball seats, said vacuum retaining said plurality of solder balls in each said plurality of ball seats and said pressurized gas releasing said plurality of solder balls from said plurality of ball seats;
a solder ball dispenser supplying said plurality of solder balls to said pickup tool, comprising:
a tubular ramp for feeding said plurality of solder balls to said plurality of ball seats, said ramp having an upper end and a lower end;
a controllable valve at the lower end of said ramp for releasing a single solder ball of said plurality of solder balls to [said] a ball seat of said plurality of ball seats while a vacuum is applied to said plurality of ball seats;
a reservoir for providing a supply of solder balls to move downwardly through said ramp.

13. (Amended) The pickup tool of claim 12, further comprising:
a gas inlet in said reservoir, said gas inlet connected to said pressurized gas providing gas flow through said plurality of solder balls providing a non-interrupted flow of said plurality of solder balls through said ramp.

16. (Amended) The pickup tool of claim 15, further comprising:
a heater to heat said plurality of solder balls to a temperature to bond to said bond pads on said substrate.

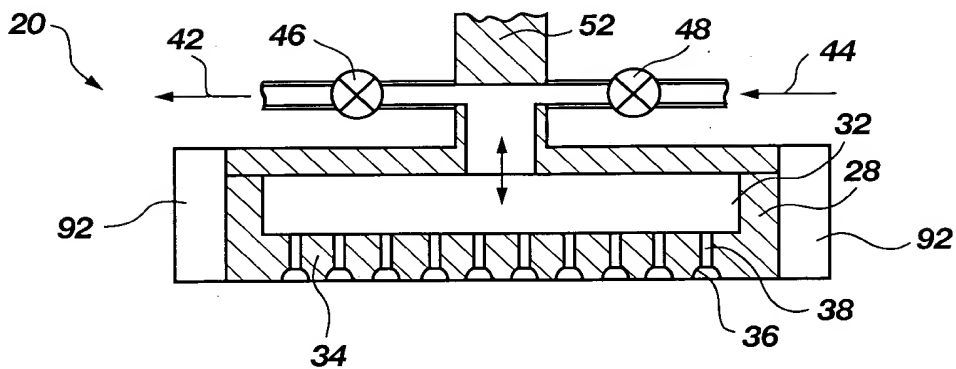


Fig. 2

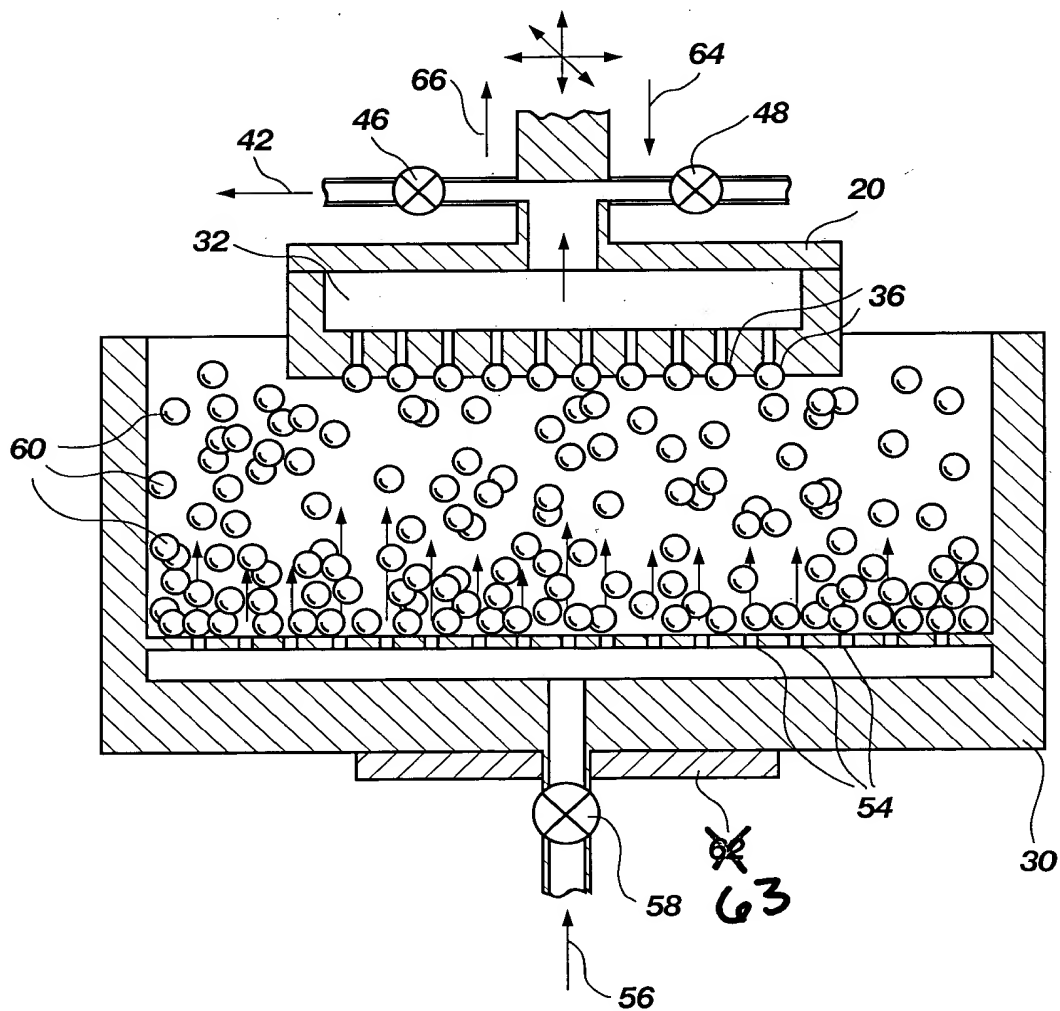


Fig. 3